

1 What is claimed is:

2
3 1. An air conditioning system, comprising:

4
5 a compressor for compressing a refrigerant, the refrigerant being a compressible phase change fluid;

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7 a condensing unit operatively connected to the compressor;

8
9 an evaporator unit and an associated expansion means operatively interconnected to the condensing
10 unit and to the compressor, the evaporator unit being in heat exchange relationship with a supply air
11 stream for an indoor space inside a structure, the compressor being operable to circulate the
12 refrigerant between the condensing unit and the evaporator unit to cool the supply air stream;

13
14 a thermal energy storage unit including a tank having a thermal energy storage medium disposed
15 therein and having an associated heat exchanger, the heat exchanger being operably connected to the
16 compressor and evaporator;

17
18 a refrigerant circulating device for circulating refrigerant through the heat exchanger in the tank and
19 between the tank and the condenser and evaporator;

20
21 wherein the refrigerant circulating device includes a prime mover and an auxiliary liquid which is
22 acted upon by the prime mover, the auxiliary liquid being coupled to the refrigerant, whereby force
23 exerted by the prime mover on the auxiliary liquid is indirectly transferred to the refrigerant.

24
25 2. The air conditioning system of claim 1, wherein the auxiliary liquid has a higher relative viscosity
26 and a lower relative vapor pressure than the refrigerant.

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28 3. The air conditioning system of claim 1, wherein the refrigerant is Freon.

29
30 4. The air conditioning system of claim 1, prime mover is a positive displacement pump.

1 5. The air conditioning system of claim 1, wherein the prime mover communicates with a pair of fluid
2 cylinders containing oil as an auxiliary fluid and wherein the prime mover exerts a motive power upon
3 pistons located within the fluid cylinders to thereby mechanically couple the motive power of the
4 prime mover to the refrigerant being circulated in the system.

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6 6. The air conditioning system of claim 1, wherein the prime mover communicates with a pair of fluid
7 cylinders containing the auxiliary fluid and wherein the prime mover exerts a motive power on a
8 flexible bladder located within the each of the fluid cylinders to thereby couple the motive power of
9 the prime mover to the refrigerant being circulated in the system.

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11 7. The air conditioning system of claim 1, wherein the prime mover is powered by a direct current
12 motor and battery.

13
14 8. The air conditioning system of claim 1, wherein the storage medium in the tank is water.

15
16 9. An air conditioning system, comprising:

17
18 a compressor for compressing a refrigerant, the refrigerant being a compressible phase change fluid;

19
20 a condensing unit operatively connected to the compressor;

21
22 an evaporator unit and an associated expansion means operatively interconnected to the condensing
23 unit and to the compressor, the evaporator unit being in heat exchange relationship with a supply air
24 stream for an indoor space inside a structure, the compressor being operable to circulate the
25 refrigerant between the condensing unit and the evaporator unit to cool the supply air stream;

26
27 a thermal energy storage unit including a tank having a thermal energy storage medium disposed
28 therein and having an associated heat exchanger, the heat exchanger being operably connected to the
29 compressor and evaporator, the thermal energy storage unit further including a temporary refrigerant
30 storage tank;

1 a refrigerant circulating device for circulating refrigerant through the heat exchanger in the tank and
2 between the tank and the condenser and evaporator;

3
4 wherein the refrigerant circulating device includes a prime mover and an auxiliary liquid which is
5 acted upon by the prime mover, the auxiliary liquid being coupled to the refrigerant, whereby force
6 exerted by the prime mover on the auxiliary liquid is indirectly transferred to the refrigerant;

7
8 a valve system for controlling the flow of refrigerant through the air conditioning system, the valve
9 system being operative to provide three distinct time periods of operation for the system, a first time
10 period which allows refrigerant to flow from the condenser to the heat exchanger of the thermal
11 energy storage unit to freeze the medium in the tank and to then return to the condenser without
12 utilizing the evaporator, a second time period which bypasses the condenser and circulates refrigerant
13 through the thermal storage unit and through the evaporator to thereby cool the supply air inside the
14 structure before returning to the thermal storage unit, and a third time period which utilizes only the
15 temporary refrigerant storage vessel of the thermal storage unit and which utilizes the condenser and
16 evaporator to cool the supply air inside the structure as if the thermal storage unit were not present.

17
18 10. The air conditioning system of claim 9, wherein the auxiliary liquid has a higher relative viscosity
19 and a lower relative vapor pressure than the refrigerant.

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21 11. The air conditioning system of claim 9, wherein the prime mover is a positive displacement pump.

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23 12. The air conditioning system of claim 9, wherein the prime mover communicates with a pair of
24 fluid cylinders containing oil as an auxiliary fluid and wherein the prime mover exerts a motive power
25 upon pistons located within the fluid cylinders to thereby mechanically couple the motive power of
26 the prime mover to the refrigerant being circulated in the system.

27
28 13. The air conditioning system of claim 9, wherein the prime mover communicates with a pair of
29 fluid cylinders containing the auxiliary fluid and wherein the prime mover exerts a motive power on
30 a flexible bladder located within the each of the fluid cylinders to thereby couple the motive power
31 of the prime mover to the refrigerant being circulated in the system.

1 14. The air conditioning system of claim 9, wherein the prime mover is powered by a direct current
2 motor and battery.

3
4 15. The air conditioning system of claim 9, wherein the storage medium in the tank is water.

5
6 16. A method of operating an air conditioning system having a compressor, a condensing unit, an
7 expansion unit and an evaporator, all operative interconnected, the evaporator unit being in heat
8 exchange relationship with a supply air stream for an indoor space inside a structure, the compressor
9 being located exterior to the structure and being operable to circulate refrigerant between the
10 condensing unit and the evaporator unit to cool the supply air stream, the method comprising the
11 steps of:

12
13 locating a thermal energy storage unit exterior to the structure to be cooled and connecting the
14 thermal storage unit solely to refrigerant lines running to and from the compressor without altering
15 the existing expansion unit and evaporator unit;

16
17 operating the air conditioning system through at least two distinct phases of operation, one phase of
18 operation including the running of the compressor to supply refrigerant to the expansion unit and the
19 evaporator unit to cool the indoor space inside the structure and another distinct phase of operation
20 being the operation of the thermal energy storage unit to exactly simulate the running of the
21 compressor without powering the compressor.

22
23 17. The method of claim 16, wherein the thermal storage unit includes a tank, a storage medium
24 within the tank, and a heat exchanger located in the tank.

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26 18. The method of claim 17, wherein the system is further provided with a refrigerant circulating
27 device for circulating refrigerant through the heat exchanger in the tank and between the tank and the
28 condenser and evaporator unit; wherein the refrigerant circulating device includes a prime mover and
29 an auxiliary liquid which is acted upon by the prime mover, the auxiliary liquid being coupled to the
30 refrigerant, whereby force exerted by the prime mover on the auxiliary liquid is indirectly transferred
31 to the refrigerant.

1 19. The method of claim 18, wherein the auxiliary liquid has a higher relative viscosity and a lower
2 relative vapor pressure than the refrigerant.

3
4 20. The method of claim 18, wherein the prime mover is a positive displacement pump.

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6 21. The method of claim 18, wherein the prime mover communicates with a pair of fluid cylinders
7 containing oil as an auxiliary fluid and wherein the prime mover exerts a motive power upon pistons
8 located within the fluid cylinders to thereby mechanically couple the motive power of the prime mover
9 to the refrigerant being circulated in the system.

10
11 22. The method of claim 18, wherein the prime mover communicates with a pair of fluid cylinders
12 containing the auxiliary fluid and wherein the prime mover exerts a motive power on a flexible bladder
13 located within the each of the fluid cylinders to thereby couple the motive power of the prime mover
14 to the refrigerant being circulated in the system.

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16 23. The method of claim 18, wherein the prime mover is powered by a direct current motor which
17 is connected to a battery as an energy source.

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19 24. A method of operating an air conditioning system having a compressor, a condensing unit, an
20 expansion unit and an evaporator, all operative interconnected, the evaporator unit being in heat
21 exchange relationship with a supply air stream for an indoor space inside a structure, the compressor
22 being located exterior to the structure and being operable to circulate refrigerant between the
23 condensing unit and the evaporator unit to cool the supply air stream, the method comprising the
24 steps of:

25
26 locating a thermal energy storage unit exterior to the structure to be cooled and connecting the
27 thermal storage unit solely to refrigerant lines running to and from the compressor without altering
28 the existing expansion unit and evaporator unit;

29
30 providing control means for controlling the flow of refrigerant through the air conditioning system,
31 control means being operative to provide three distinct time periods of operation for the system, a

1 first time period which allows refrigerant to flow from the condenser to the heat exchanger of the
2 thermal energy storage unit to freeze the medium in the tank and to then return to the condensing unit
3 without utilizing the evaporating unit, a second time period which bypasses the condensing unit and
4 circulates refrigerant through the thermal storage unit and through the evaporating unit to thereby
5 cool the supply air inside the structure before returning to the thermal storage unit, and a third time
6 period which utilizes only the temporary refrigerant storage vessel of the thermal storage unit and
7 which utilizes the condensing unit and evaporating unit to cool the supply air inside the structure as
8 if the thermal storage unit were not present.

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10 25. The method of claim 24, wherein a refrigerant circulating device is provided for circulating
11 refrigerant through the heat exchanger in the tank and between the tank and the condensing unit and
12 evaporating unit;

13
14 wherein the refrigerant circulating device includes a prime mover and an auxiliary liquid which is
15 acted upon by the prime mover, the auxiliary liquid being coupled to the refrigerant, whereby force
16 exerted by the prime mover on the auxiliary liquid is indirectly transferred to the refrigerant.